

BRIDGE DECK DRAINAGE

1. Basic Concepts

Bridge drainage covers the collection and removal of waters from a bridge deck. To accomplish this function, drains are placed adjacent to curbs for collection of water which is then either dumped directly on the ground or is conveyed to a suitable disposal point.

2. Bridge Deck Drainage is Divided Into Two Classes

Class I. All locations, usually urban, where drainage must be carried via piping to some suitable disposal point. Short vertical or near vertical down spouts to clear girder flanges are not considered in this category.

Class II. All locations, usually rural, where drainage may be disposed of by free fall directly under the drain.

3. There Are Four Standard Types of Structure Drains

Type A. To be used for Class II drainage at locations adjacent to median curbs where a grating is desirable.

Type B. To be used for Class II drainage at locations adjacent to barrier rail curbs. This is the most frequently used Class II drain.

Type C. To be used for both Class I and Class II drainage. Intended primarily for use on steel or precast girder construction where there is no main reinforcing running longitudinally in the deck to conflict with a drain of this size. This drain will intercept more deck run-off than other types.

Type D. To be used for Class I Drainage and is the type most commonly used for this class.

D-1 has a deep basin and is intended for use at locations where it can be properly concealed.

D-2 has a shallow basin and is intended for use in deck overhangs.

4. Structure Drains for Special Applications

Double Wide Type D Drain. When hydraulic demand exceeds the capacity of a single Type D drain inlet, consider using a double wide Type D drain.

Slotted Drains. Slotted drains in bridge decks should be used only to intercept sheet-flow. Drains should be located in the shoulder either normal to traffic or parallel to traffic, 12" from edge of

Supersedes Memo to Designers 18-1 dated April 22, 1975

outside traffic lane. For wide bridges with flat cross slopes, additional drains may be located 12" from traffic lane lines.

Drop-Thru Drains and Scuppers. The concern in providing drop-thru drains and scuppers may concern the water as well as the possibility of debris dropping through the drain or passing through the scupper opening. Possible locations for drop-thru drains or scuppers would be appropriate when the drain is located:

- a. Over open land, landscaped areas, shoulders and medians of State highways and freeways.
- b. Over local streets and roads with light traffic volumes.
- c. In an overhead over areas away from railroad tracks. (Check with Agreements).
- d. Over irrigation canals, drainage waterways, streams and creeks unless the water is contaminated with road salt. Fish and game approval is required for these locations.

5. Drain Inlet Location

It will be Division of Structures policy to specifically provide drains at the following locations:

- a. At low points where there is a sag vertical curve.
- b. Where the deck grade is so flat that ponding will occur at bents because of initial residual camber.
- c. Adjacent to any area where water will cross the deck due to reversal of superelevation or the termination of a curb nosing which separates two roadways.
- d. Adjacent to expansion joints in structures .
- e. At locations away from bents to avoid mild steel and prestressing ducts.

6. Drainage Disposal

Drainage disposal is required for Class I drainage only. It is accomplished in one of two ways via concealed piping by either:

- a. Coming out at ground level adjacent to a gutter or other disposal area; or
- b. Coming out underground into a catch basin or connecting to a storm drain.

Consult with the District to determine the best method.

7. Criteria For Piping

- a. Exposed piping detracts from the appearance of the structure and should be avoided.
- b. Piping should be 6" minimum diameter welded steel pipe with $\frac{1}{8}$ " minimum wall thickness. Eight inch piping is preferred for multiple inlets, flat slopes, or runs of 50' or more. Runs should be on as steep a grade as conditions will allow with a maximum of 4 inlets per run. Inlets should be located up grade from the bent or abutment outlets whenever possible. All

- bends should be smooth and on a 18" minimum radius for 6" ϕ pipe and a 24" minimum radius for 8" ϕ pipe. Mitered bends shall not be used. The length of near horizontal (2 percent minimum) runs should be kept to a minimum.
- c. Expansion couplings must be shown on the plans where drain pipes cross expansion joints at hinges and abutments.
 - d. The use of cleanout openings must be given careful consideration by the designer. When the piping system consists of a single run from inlet to outlet, cleaning is usually done from the outlet end with a power driven plumber's auger. For this situation, a cleanout opening should not be used, because it may provide a "blind alley" for the auger and make cleaning from the outlet impossible. For a more complex piping system, properly placed cleanout openings can facilitate cleaning by providing additional access points in the line.

8. Design Procedures And Details

Refer to *Bridge Design Aids*, Section 17.



Philip C Warriner



RFB:jgf

18-1 BRIDGE DECK DRAINAGE

1. Basic Concepts

Bridge drainage covers the collection and removal of waters from a bridge deck. To accomplish this function, drains are placed adjacent to curbs for collection of water which is then either dumped directly on the ground or is conveyed to a suitable disposal point.

2. Bridge Deck Drainage is Divided into Two Classes

- *Class I.* All locations, usually urban, where drainage must be carried via piping to some suitable disposal point. Short vertical or near vertical down spouts to clear girder flanges are not considered in this category.
- *Class II.* All locations, usually rural, where drainage may be disposed of by free fall directly under the drain.

3. Four Standard Types of Structure Drains

- *Type A.* To be used for Class II drainage at locations adjacent to median curbs where a grating is desirable.
- *Type B.* To be used for Class II drainage at locations adjacent to barrier rail curbs. This is the most frequently used Class II drain.
- *Type C.* To be used for both Class I and Class II drainage. Intended primarily for use on steel or precast girder construction where there is no main reinforcing running longitudinally in the deck to conflict with a drain of this size. This drain will intercept more deck runoff than other types.
- *Type D.* To be used for Class I Drainage and is the type most commonly used for this class. D-1 has a deep basin and is intended for use at locations where it can be properly concealed. D-2 has a shallow basin and is intended for use in deck overhangs.

Memo converted to metric.

4. Structure Drains for Special Applications

- *Double Wide Type D Drain.* When hydraulic demand exceeds the capacity of a single Type D drain inlet, consider using a double wide Type D drain.
- *Slotted Drains.* Slotted drains in bridge decks should be used only to intercept sheet-flow. Drains should be located in the shoulder either normal to traffic or parallel to traffic, 300 mm from edge of outside traffic lane. For wide bridges with flat cross slopes, additional drains may be located 300 mm from traffic lane lines.
- *Drop-Thru Drains and Scuppers.* The concern in providing drop-thru drains and scuppers may concern the water as well as the possibility of debris dropping through the drain or passing through the scupper opening. Possible locations for drop-thru drains or scuppers would be appropriate when the drain is located:
 - a. Over open land, landscaped areas, shoulders and medians of State highways and freeways.
 - b. Over local streets and roads with light traffic volumes.
 - c. In an overhead over areas away from railroad tracks. (Check with Agreements).
 - d. Over irrigation canals, drainage waterways, streams and creeks unless the water is contaminated with road salt. Fish and game approval is required for these locations.

5. Drain Inlet Location

It will be Division of Structures policy to specifically provide drains at the following locations:

- a. At low points where there is a sag vertical curve.
- b. Where the deck grade is so flat that ponding will occur at bents because of initial residual camber.
- c. Adjacent to any area where water will cross the deck due to reversal of superelevation or the termination of a curb nosing which separates two roadways.
- d. Adjacent to expansion joint seal assemblies in bridge decks.
- e. At locations away from bents to avoid mild steel and prestressing ducts.

6. Drainage Disposal

Drainage disposal is required for Class I drainage only. It is accomplished in one of two ways via concealed piping by either:

- a. Coming out at ground level adjacent to a gutter or other disposal area; or
- b. Coming out underground into a catch basin or connecting to a storm drain.

Consult with the District to determine the best method.

7. Criteria for Piping

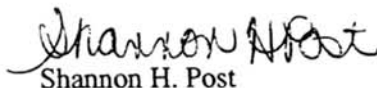
- a. Exposed piping detracts from the appearance of the structure and should be avoided.
- b. Piping should be 150 mm minimum diameter welded steel pipe with 3 mm minimum wall thickness. For multiple inlets, flat slopes, or runs of 15 m or more, 200 mm piping is preferred. Runs should be on as steep a grade as conditions will allow with a maximum of 4 inlets per run. Inlets should be located upgrade from the bent or abutment outlets whenever possible. All bends should be smooth and on a 450 mm minimum radius for 150 mm diameter pipe and a 600 mm minimum radius for 200 mm diameter pipe. Mitered bends shall not be used. The length of near horizontal (2 percent minimum) runs should be kept to a minimum.
- c. Expansion couplings must be shown on the plans where drain pipes cross expansion joints at hinges and abutments.
- d. The use of cleanout openings must be given careful consideration by the designer. When the piping system consists of a single run from inlet to outlet, cleaning is usually done from the outlet end with a power driven plumber's auger. For this situation, a cleanout opening should not be used, because it may provide a "blind alley" for the auger and make cleaning from the outlet impossible. For a more complex piping system, properly placed cleanout openings can facilitate cleaning by providing additional access points in the line.

8. Design Procedures and Details

Refer to *Bridge Design Aids*, Section 17.

A handwritten signature in cursive script, appearing to read "Richard D. Land".

Richard D. Land

A handwritten signature in cursive script, appearing to read "Shannon H. Post".

Shannon H. Post

SDW:jgf/jlw